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NEW SYRPHIDAE FROM NORTH AMERICA (Diptera)

C. L. Fluke[1]

The following new species were found in a large collection of undetermined Syrphidae from the Snow Entomological Collection. The types are deposited in that collection. Available paratypes are in the Fluke collection and the American Museum of Natural History.

Mesograpta teligera, new species
Figures 1, 2

Related to *anchorata* Macquart, differing in the abdominal pattern. Four front tibiae and femora, the hind coxae and basal half of the hind femora, yellow; sides of the mesonotum and rim of the scutellum yellow. Length about 9.5 mm.

Male: Face, front and cheeks yellow; a narrow dark band separates the cheeks from the face. Sides of the face whitish pubescent and yellow pilose; front yellow pilose; cheeks lightly coated with white pubescence which becomes gray to brown on the upper occiput and down the vertex almost to the ocelli where there is a shining area just above the ocellar triangle. Ocelli located about midway between the occipital edge and the ocular corner of the front, a gray pubescent spot in front of the anterior ocellus. Occipital pile yellow above, white below. Antennae yellow, the third segment slightly darker.

Mesonotum dark brown pollinose with the mid blue vitta very distinct, the sides broadly shining yellow, pile short and pale yellow; pleura dark with the posterior half of the mesopleura, upper part of the sternopleura, and a spot above the front coxae yellow, pile yellowish. Scutellum dark brown, the border yellow, pile short and all black.

Legs yellow; apical half of the hind femora, the hind tibiae and all the tarsi reddish to brownish. Wings hyaline, the stigma darkened; plumule and squamae pale; halteres yellow; alulae well developed. The third longitudinal vein rather strongly curved into the first posterior cell.

Abdomen generally shining black with yellow maculations. First tergite broadly yellow on the basal corners; second with a broad yellow band on the anterior half; third yellow basally with extensions approaching the mid line; fourth similar to the third with a median yellow vitta; fifth yellow with three black markings, an oval one on each side and an arrow-head shaped one in the middle. Genital parts bulbous; the surstyli broad and long, yellow. Venter entirely shining yellow with a median dark streak basally.

Holotype male, Baboquivari Mountains, Arizona, July 19, 1950 (W. J. Arnold); paratype male same place and date (H. O. Wright).

This species belongs to those larger *Mesograpta* such as *anchorata, tibicen,* etc. It appears that it should be known but a diligent search has revealed no species like it.

[1] University of Wisconsin, Madison.

Lepidostola micheneri, new species
Figures 3, 4, 5

Mesonotum thickly covered with golden scales, scattered white scales on the face and abdomen. Length 6.5 mm.

Male: Face shining black, the sides next to the eyes with connected patches of pale and darker pubescence, the tubercle low with scattered whitish scales, pale pile on the lower slopes and around the oral opening; cheeks shining with sparse pale pile; frontal triangle shining black, the upper angle with pale pubescence which is not connected to the pubescence on the sides of the face; a median groove from the angle to the antennal base. Ocellar triangle quite prominent, shining black with golden pile behind. Occiput cinerous pubescent below, shining above, the pile pale. Antennae elongate, pale brown, somewhat yellowish at the base of the third segment, darker towards the tip.

Thorax shining black, the mesonotum well covered with brassy scales concealing the ground color; pleura shining with scattered brassy scales. Scutellum strongly pointed posteriorly, shining black with pale brassy pile, no scales.

Legs shining; the femora black, yellow on the basal fourth or less; tibiae yellow; basal two segments of the front tarsi and basal three segments of the mid and hind tarsi whitish yellow, the apical segments blackish. All the femora with stout short spines below, confined to the apical half on the two front femora; pile of the legs short, fine, and generally yellowish. Hind femora considerably swollen. Wings hyaline, slightly infuscated, the stigma yellow; apical crossvein angulated with a stub of a vein into the first posterior cell; halteres yellow; squamae pale brownish.

Abdomen black, the second and third tergites opaque on the disc, the fourth shining with indications of opaque areas on each side; these areas covered with circular shining spots which are probably the spots covered with yellow scales which have been rubbed off (only one scale remains); the pile pale, short, longer on the sides of the second segment.

Holotye male, Southmost, Cameron Co., Texas, March 21, 1951 (C. D. Michener) taken on *Agestoche breviflora.*

This is to my knowledge the first *Lepidostola* taken in the continental United States. The place however is undoubtedly tropical as it is just across the line from Mexico.

There is a possibility but highly improbable, that this is the male of Hull's species *stellata* which was described from a female collected in Brazil. It differs in the number of scales on the mesonotum, wing venation and color of the legs. The only species of *Lepidostola* with close geographical ranges are from Cuba (*calopus*), Mexico (*perpolita*), and Panama (*jenningsi*). *L. micheneri* cannot possibly be any of these.

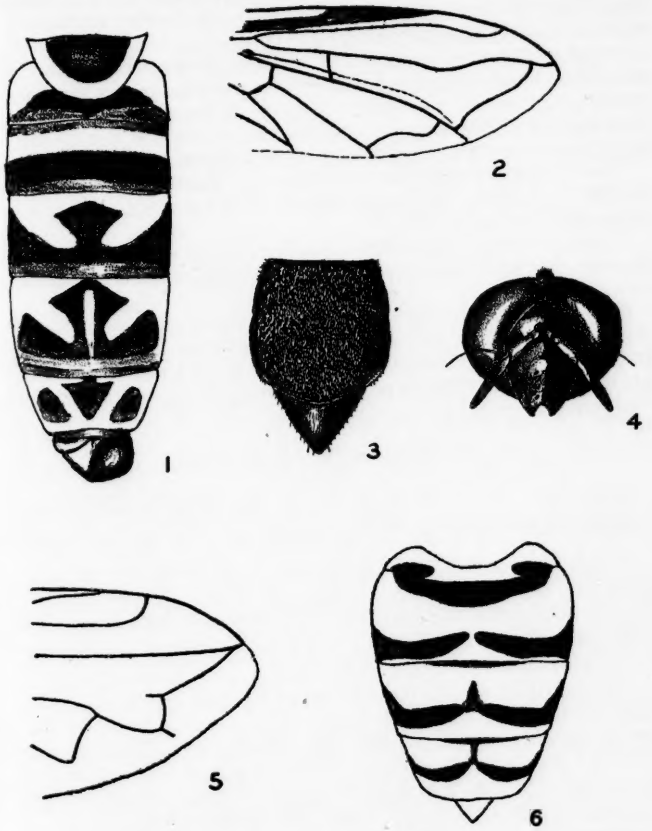
Heliophilus azureus, new species

Metasternum pubescent, mesonotum black with purple reflections, abdomen metallic reddish bronze. Length 10 to 12 mm.

Male: Head black, face covered with gray pollen; front with a large rectangular shining spot above the antennae, rest heavily yellowish pollinose,

non-pilose; cheeks shining with white pile; ocellar triangle shining blue-black, narrowly elongate anteriorly, the pile black, paler behind; upper occiput shining, without pollen, yellowish pilose, lower half gray pollinose and white pilose. First two segments of the antennae shining black, the third large and reddish brown, dull; arista long and reddish brown.

Thorax black, the mesonotum dull with purple reflections, a pair of gray median vittae that disappear posteriorly; the pile decumbent and brassy with



EXPLANATION OF FIGURES.

Figures 1-6. 1. *Mesograpta teligera*, new species, abdomen of male. 2. *Mesograpta teligera*, wing. 3. *Lepidostola micheneri*, new species, mesonotum and scutellum. 4. *Lepidostola micheneri*, front of head. 5. *Lepidostola micheneri*, apex of wing. 6. *Parhelophilus currani*, new species, abdomen of female.

a few long upright hairs in front of the scutellum; pile of the posterior calli all yellowish and there are no black setae above the wings; scutellum same as mesonotum, with apical and preapical grooves; pile pale, longer on the margin. Pleura black and lightly yellowish pollinose, the mesopleura with purple reflections; pile all whitish. Legs black, the tibiae somewhat reddish brown, paler at their bases; pile yellowish, black on the hind tibiae and tarsi and on the apical segments of the other tarsi; hind femora with numerous stubby bristles on the undersides. Wings conspicuously brownish and somewhat darker near the stigma; squamae white, the fringe yellowish brown; plumule brownish; halteres yellow.

Abdomen everywhere metallic with reddish bronze reflections and numerous black blotches, especially the first tergite; pile dorsally short and decumbent, yellow with evidence of black pile on the posterior borders of the third and fourth tergites; pile of the venter short with numerous erect and long hairs on each sternite; pile of the exposed genitalia black.

Female: Very similar, the front shining, slightly narrowing above, the pile short and black. The two females at hand somewhat smaller than the males and both a little teneral.

Types: Holotype, male, Cloudcroft, New Mexico, June 29, 1932 (R. H. Beamer); allotype female, same data; paratypes, three males and one female same data.

The only species this might possibly be confused with is *pigra* Fabr. which also has entirely black legs and a reddish abdomen. The color on the abdomen of *azureus* is a different shade and somewhat mottled, covering the first tergite as well as the rest of the abdomen. It can best be told by the purplish reflections on the mesonotum.

Parhelophilus currani, new species

Figure 6

A yellowish-orange colored species related to *laetus* but larger and paler, the abdomen mostly orange colored with narrow black fasciae. Length 10 to 11 mm.

Female: Face yellow, well coated with yellow pollen and the sides with yellow pile, oral edge somewhat shining; cheeks yellow with yellow pollen and pile; front yellow but darkened above, the pollen yellow, pile all black; occiput yellow pollinose, the pile a pale yellow. Antennae yellow; arista yellow, darker apically.

Thorax black, opaque, the sides broadly yellowish pollinose, the mesonotum with two broad yellow pollinose vittae, a very narrow yellow median vitta on the anterior half; pile all golden yellow; pleura darker especially below, more heavily yellow pollinose above, the pile all yellow. Scutellum entirely yellow, the pile long and yellow on the borders, shorter and black on the disc. Plumule, squamae and fringe, and halteres yellow.

Legs yellow, the coxae, trochanters and hind tarsi blackish; the apical third of the hind tibiae dark and there is a black smudge dorsally on the hind femora, also slight indications of darkening on the apical half or less of the hind femora; pile all pale, tiny spicules at the apex of the mid tibiae and on the undersides of the mid tarsi black; the usual black stiff hair or bristles

or the under apical surface of the hind femora, becoming shorter and absent basally; pile on the outer side of the hind tibiae and the dorsal side of the hind tarsi black. Wings hyaline, the veins yellowish.

Abdomen primarily orange colored with four narrow black, arched fasciae, the first beginning on the apical margins of the first tergite and crossing the basal margin of the second in the middle; the second on the apical margin of the second tergite, projecting anteriorly a little in the middle and leaves the extreme apex of the tergite yellowish; the third band on the next tergite similar to the second but projecting more in the middle; the band on the fourth tergite also similar but narrower; fifth tergite with a faint band; bases of third to fifth tergites narrowly black. Pile mostly yellow, black on the apical third of each tergite. Venter mostly yellow, the third, fourth and fifth sternites each blackish on the disc.

Male, similar, the pile of the front entirely yellow, the hind legs much paler but the specimen may be somewhat teneral. The genitalia yellow, pile all yellow.

Holotype female 15 miles East Creole, Louisiana, June 18, 1948 (H. W. Crowley); allotype male, Creole, La., June 17, 1948 (R. H. Beamer); paratype, female, same data as allotype (B. T. McDermott).

The female was selected as holotype as it appeared to be more normally colored and the male was slightly crippled.

DIPTEROUS LARVAE INFESTING THE INTESTINAL TRACT OF THE COYOTE, *CANIS LATRANS* SAY 1823

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During a study of the intestinal parasites of the coyote, *Canis latrans* Say 1823, in Utah, dipterous larvae were recovered from the intestinal tracts of three specimens. In each case the larvae were located in the anterior portion of the large intestine near its union to the small intestine, and the fact that no apparent digestion was evident and that internal morphological characters and structures were excellently preserved is taken as evidence of the living condition of the larvae at the time of preservation of the tracts. Examination of the intestinal walls in the region from which the larvae were removed revealed no pathological damage that could be ascribed to the larvae. All larvae were recovered from the bowel contents indicating that they were probably passing through in the food.

None of the three species recovered is known to produce intestinal myiasis in animals and the lack of pathology in these instances seems to indicate that true intestinal myiasis did not occur. However, it has not been previously known that such species as *Callitroga americana, C. macellaria* and *Wohlfahrtia opaca* could pass in a living state through the digestive tracts of carnivorous animals following ingestion with food, presumably of prey species that had received the initial infestation with the fly larvae.

Each of the cases reported involved infestation by a separate species of fly larvae. Each of the three specimens producing dipterous infestations was collected during September and October of 1951 from the southern part of the State of Utah by the field hunters of the Predator and Rodent Control Division of the Fish and Wildlife Service. The first case involved a coyote collected on October 11, 1951 in the Blue Mountains (Abajo Mts.) of San Juan County. This animal possessed six first and 45 second instar larvae of *C. americana* (Cushing and Patton), the primary screw worm fly. The animal was collected and the intestinal tract removed and preserved in 10 per cent formaldehyde by the hunters in the field. For this reason, it was not possible to determine whether myiasis other than through ingestion of larvae had occurred, although such a supposition cannot be entirely disregarded. It is more logical to assume, however, that larvae were passing through the tract in a living state following the ingestion of animal food material containing them. *C. americana,* as reported by James (1947) and others, oviposits only on living warm-blooded animals in nature and is not known to oviposit on carrion. In this respect, Travis, Knipling and Brody (1940) found that the larvae began migrating from the host immediately following its death and that all larvae had departed after 48 hours leading to the conclusion that the prey species containing the larvae in this case was probably living when attacked and eaten by the coyote. This prey species could not be determined from intestinal contents. Further evidence as reported by Laake, Cushing and Parish (1936), and Knipling and Rainwater (1937), indicates that *C. americana* has been found to be important only in dermal myiasis and that the fly is primarily attracted to wounds from two to ten days old. Life history studies show that the larval period of this species is from four to eight days, depending on the temperature. Since larvae of several instars were present, indications are that at least two separate ovipositions had occurred previously on the prey species, and it is concluded that this case of myiasis was secondary in the coyote through the ingestion of the larvae with food.

The second case of myiasis reported consisted of six second and ten third instar larvae of *Callitroga macellaria* (Fabricius) taken from a coyote collected September 1, 1951 in Beaver County, Utah. This species, the adult of which is termed the secondary screw worm fly, is known to ovipost principally on carrion, and only occasionally in the wounds of living animals. When oviposition on living animals occurs, it is generally in infected wounds that are discharging, or in soiled wool and fur where factors exist that attract and are conducive to fly-blowing. Animals infested in this manner are usually killed by the infestation unless treated.

C. macellaria, furthermore, is one of the most common species of blow fly in Utah and may be collected in numbers about carrion. Recent severe winters have produced heavy kills of deer and other animals providing an abundant breeding source for this and other blow fly species and have caused a great increase in the number of adult flies present in most Utah areas. Development of the larvae takes from 9 to 39 days depending on the temperature and moisture. From the advanced instars recovered in this case, it is assumed that the coyote ingested them with the flesh of carrion and that the larvae were not killed by passage through the digestive tract. Sperry (1940),

in his study of the food habits of the coyote, has indicated that about 25 per cent of the food eaten annually consisted of carrion providing an excellent basis for this conclusion.

The third case of myiasis reported in the coyote consisted of 21 second instar larvae of *Wohlfahrtia opaca* (Coquillett) taken from a specimen collected October 30, 1951 in Iron County, Utah. The larvae were recovered from the upper region of the colon and examination of the intestinal wall revealed no damage and suggested that the larvae were ingested with food. This species of fly has been reported as attacking the young of many species of animals and the larvae apparently possesses the ability to penetrate the unbroken skin, at least in the very young. Adult animals are rarely parasitized. In laboratory studies, the fly normally oviposits on living, warm-blooded animals and oviposits on carrion only as a last resort. In the Salt Lake City region the species has been injurious to domestic mink production where it has been found to attack the kits producing considerable loss. A related species *W. vigil* (Walker) has been similarly reported by O'Donoghue (1949) and Strickland (1949) as attacking mink in Canada. O'Donoghue also reports a case of rectal myiasis in mink involving this species. During the autumn of 1951, three human cases of myiasis involving *W. opaca* have occurred in the Salt Lake area, all in small children, and it is likely that the young of many species of local mammals, a number of which are prey species for the coyotes, are also attacked.

Summary

Three cases of intestinal myiasis are reported for the coyote, *Canis latrans* Say 1923, in Utah, and involving separate species of Dipterous larvae in each instance. The larvae were recovered from the upper portion of the large intestine in each case and inspection of the intestinal wall indicated no pathological damage leading to the conclusion that the larvae were passing through with the food. Condition of the larvae when examined indicated that they were living when the intestinal tracts were preserved. Recovered were six first and 45 second instar larvae of *Callitroga americana* (Cushing and Patton), six second and ten third instar larvae of *Callitroga macellaria* (Fabricius), and 21 second instar larvae of *Wohlfahrtia opaca* (Coquillett).

LITERATURE CITED

JAMES, M. T. 1947. The flies that cause myiasis in man. U.S. Dept. Agri. Misc. Pub. 731: 7-175.

KNIPLING, E. F. and RAINWATER, H. T. 1937. Species and incidence of dipterous larvae concerned in wound myiasis. J. Parasit. 23: 451-455.

LAAKE, E. W.: CUSHING, and PARRISH, H. E. 1936. Biology of the primary screw worm fly *C. americana* and a comparison with those of *Cochliomyia macellaria*. U. S. Dept. Agri. Tech. Bull. 500: 1-24.

O'DONOGHUE, J. G. 1949. Reports of flesh flies in mink in Alberta. Canad. J. Comp. Med. 13: 3-6.

SPERRY, C. C. 1941. Food habits of the coyote. Wildlife Research Bulletin, U. S. Fish and Wildlife Service 4: 64-65.

STRICKLAND, E. H. 1949. *Wohlfahrtia* myiasis of mink in Alberta. Canad. Entom. 81: 58-60.

NEW NORTH AMERICAN MALLOPHAGA

K. C. EMERSON
Stillwater, Oklahoma

Through the kindness of Dr. L. A. Carruth, the writer recently examined the Mallophaga Collection of the University of Arizona. Described herein are five new species from that material, all of which were collected by Dr. Allan R. Phillip. All holotype and allotype material has been deposited in the United States Nationa Museum, and paratypes have been distributed to other leading museums.

Philopterus phillipi n. sp.

Male: Total length 1.85 mm., greatest width 0.85 mm. The head length and width are the same, 0.60 mm. Forehead broad, signature prominent and pointed posteriorly; clypeus narrow. Ocular emarginations shallow and broadly curved. Trabeculae large. Antennae filiform, with large first segments and long second segments. Eyes large, each with a long seta. Temples evenly ronded. Prothorax small; sides convex, with a long seta in each posterolateral angle. Pterothorax with sides diverging distally. Abdomen wide, with prominent chitinous plates; each segment with one row of marginal setae. Dorsal chaetotaxy as shown in figure 1. Male genitalia as shown in figure 3.

Female: Total length 2.10 mm., greatest width 0.90 mm. All measurements, except for the abdomen, are the same as for the male. Chaetotaxy same as for the male, except for the abdominal terminal segments.

Type host: *Cyanocephalus cyanocephalus* (Wied), Pinon Jay.

Type material: Holotype male, allotype female and eight paratypes collected at Flagstaff, Arizona.

This species is very similar to *Philopterus cristatus* Malcomson 1929 found on the Blue Jay, and *Philopterus corvi* (Linnaeus 1758) found on the Raven. It differs from both in the form of the tergal plates, the chaetotaxy, and the structure of the male genitalia. The short parameres easily distinguish it from related species.

Degeeriella carruthi n. sp.

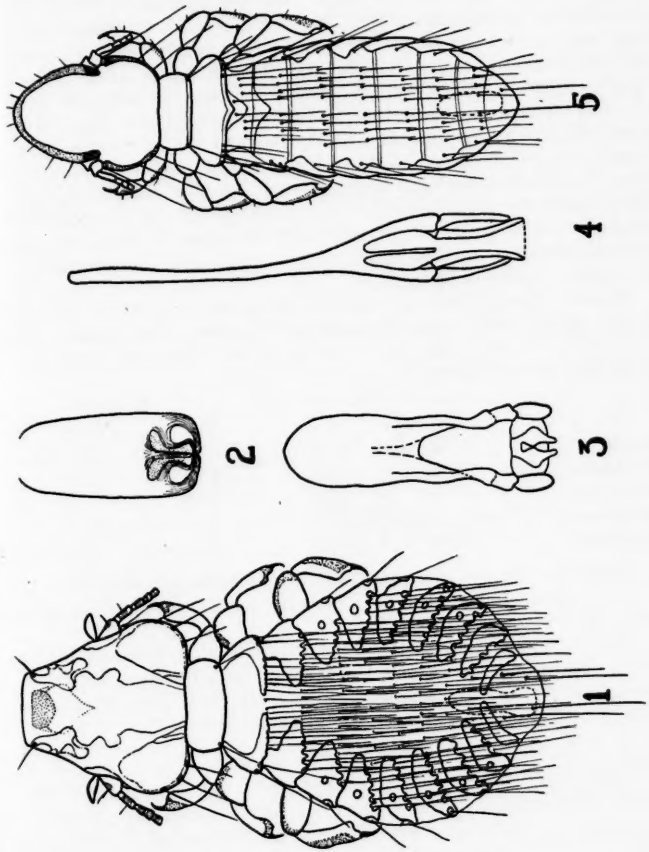
Male: Total length 1.80 mm., greatest width 0.5 mm. Head 0.52 mm. in length and 0.40 mm. in width. Head circumfasciate; almost pointed, with narrow clypeal margin. Eyes inconspicuous, each with a long seta arising from the dorsal surface. Antennae filiform. Temples convexly rounded with narrow marginal bands. Prothorax short, wide, and armed dorsally with one long seta in each posterolateral angle. Pterothorax with sides diverging distally, posterior margin pointed distally in the median. Abdomen with weakly chitinized tergal plates and heavily chitinized pleural plates. Tergal plates each with one row of medium-length setae, except for the terminal segments. Dorsal chaetotaxy as shown in figure 5. Male genitalia as shown in figure 2.

Female: Total length 2.10 mm., greatest width 0.52 mm. The head and abdomen are longer than in the male, all other measurements are the same. The chaetotaxy same as for the male, except for the abdominal terminal segments.

Type host: *Falco sparverius sparverius* Linnaeus, Eastern Sparrow Hawk.

Type material: Holotype male, allotype female and eight paratypes collected at Flagstaff, Arizona.

This species is very similar to *Degeeriella fasciata* (Rudow 1869) found on



EXPLANATION OF ILLUSTRATIONS

Plate I

Figure 1. *Philopterus phillipi* n. sp., Male, dorsal.
Figure 2. *Degeeriella carruthi* n. sp., Male genitalia.
Figure 3. *Philopterus phillipi* n. sp., Male genitalia.
Figure 4. *Actornithophilus mexicanus* n. sp., Male genitalia.
Figure 5. *Degeeriella carruthi* n. sp., Male, dorsal.

the Gyrfalcon. The new form is smaller and possesses a more pointed head. The male genitalia easily distinguishes it from related species.

Actornithophilus mexicanus n. sp.

Male: Head of a shape typical of the genus. Temples prominent, ocular emarginations rather deep. Eyes large. Two long setae on the lateral margins of the ocular emarginations. Four long setae on each temporal lobe. Two long setae on each lateral margin of the gular region. Four long seate dorsally, on the posterior margin of the head. Thorax except for size, same as in *A. albus* Emerson 1948. Four large setae on the posterior margin of the patch of spines on the venter of the hind femur—the spines in the patch being progressively smaller anteriad. Abdominal tergites I-VII with twenty medium-length setae, evenly spaced on the posterior margin; and with scattered small setae. Pleural plates with one long and numerous short setae in each posterolateral angle. Sternal plates with three rows of evenly spaced medium-length setae. Patches of spines on the posterolateral angles of abdominal sternites four and five; the patch on sternite four being more prominent and dense. Genitalia as shown in figure 4.

Female: Larger than the male and of essentially the same form, there being a minimum of sexual dimorphism. The setae on the dorsum of the female are less numerous and all are larger than on the male. Measurements of the types are as follows:

	Male		*Female*	
	W	*L*	*W*	*L*
Head	0.50 mm.	0.42 mm.	0.50 mm.	0.42 mm.
Prothorax	0.38	0.13	0.40	0.15
Mesothorax	0.38	0.10	0.40	0.12
Metathorax	0.42	0.12	0.50	0.13
Abdomen	0.50	1.00	0.62	1.30

Type host: *Himantopus mexicanus* (Müller), Black-necked Stilt.

Type material: Holotype male, allotype female and fourteen paratypes collected at Tucson, Arizona.

This form closely resembles *Actornithophilus albus* Emerson 1948 found on the Sanderling. The forehead in the new form is longer and much narrower, and the male is much larger than in *A. albus*. The endomeres of the male genitalia are much longer than in related species.

Penenirmus varius n. sp.

Male: Total length 1.9 mm., greatest width 0.60 mm. Head 0.5 mm. in length and 0.48 mm. in width. Forehead narrow, clypeal signature long and prominent. Preantennal lateral margins slightly expanded. Trabeculae small, narrow and pointed. Eyes conspicuous, each with a long seta. Antennae filiform. Temples evenly rounded. Posterior margin of head slightly concave. Prothorax rectangular, with one long seta in each posterolateral angle. Pterothorax large, with diverging lateral and posterior margins. Abdomen narrow and elongate. Conspicuous tergal plates, each with one row of medium-length setae. Pleurites distinct and heavily chitinized. Dorsal chaetotaxy as shown in figure 6. Male genitalia as shown in figure 8.

Female: Total length 2.15 mm., greatest width 0.62 mm. The head and abdomen are longer than in the male, all other measurements are the same. Chaetotaxy same as for the male, except for the abdominal terminal segments.

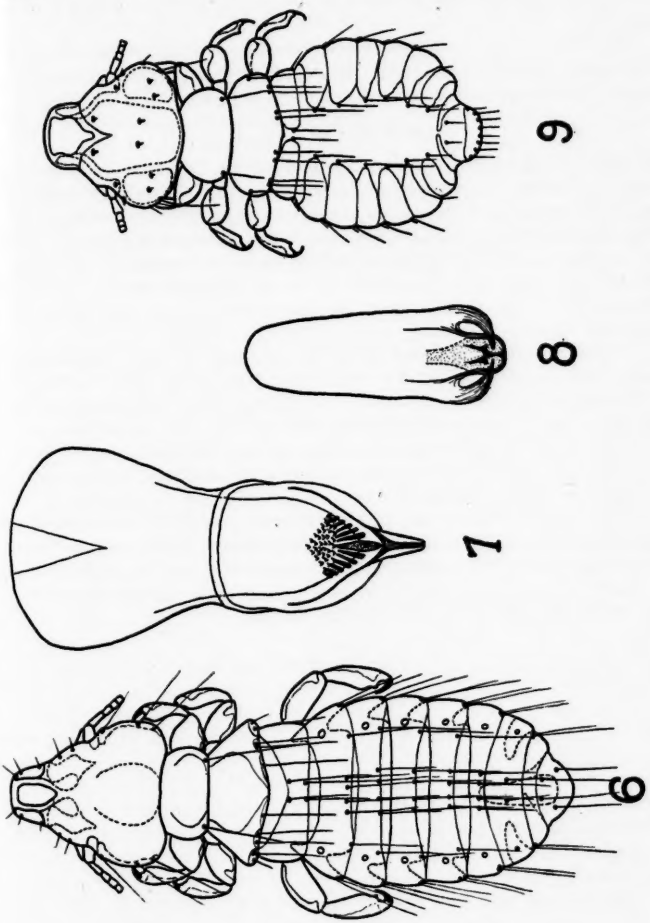


Plate II

Figure 6. *Penenirmus varius* n. sp., Male, dorsal.
Figure 7. *Anatoecus clangulus* n. sp., Male genitalia.
Figure 8. *Penenirmus varius* n. sp., Male genitalia.
Figure 9. *Anatoecus clangulus* n. sp., Male, dorsal.

Type host: *Sphyrapicus varius varius* (Linnaeus), Yellow-bellied Sapsucker.

Type material: Holotype male, allotype female and four paratypes from the type host collected in Mohave County, Arizona. Also, ten paratypes from *Sphyrapicus varius nuchalis* Baird, Red-naped Sapsucker collected in Arizona.

This species in general appearance, resembles several species of the genus. The sparse chaetotaxy, large size and distinctive male genitalia easily separate it from the known species.

Anatoecus clangulus n. sp.

Male: Total length 1.45 mm., greatest width 0.62 mm. Forehead long, broadly rounded. Clypeal signature large. Temples broadly rounded, each with one long seta. Short peg-like spines on the dorsal surface of the head as illustrated. Prothorax narrow and long. Pterothorax large, lateral margins evenly rounded with diverging lateral and posterior margins. Abdomen oval-shaped. Prominent tergal plates on the lateral margins. Median area of the abdomen clear. Dorsal chaetotaxy as shown in figure 9. Male genitalia as shown in figure 7.

Female: Head length and width are the same, 0.5 mm. Prothorax 0.18 mm. in length and 0.33 mm. in width. Pterothorax 0.20 mm. in length and 0.43 mm. in width. Abdomen 1.0 mm. in length and 0.9 mm. in width. Chaetotaxy, except for the abdominal terminal segments, same as in the male.

Type host: *Clangula hymenalis* (Linneaus), Old-squaw.

Type material: Holotype male and allotype female and sixteen paratypes collected at Tucson, Arizona.

The male genitalia of the new form closely resembles that of *Anatoecus icterodes* (Nitzsch 1818) found on the Red-breasted Merganser. In the latter named species, the parameres are shorter and stouter, and the endomeral plate is without the prominent chitinous serrations. The clypeal signature and chaetotaxy are also distinctive in the new form.

NOTES ON SOME TEXAS REDUVIIDAE (Hemiptera, Reduviidae)

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Metapterus wygodzinskyi n. sp.

Length, 14 to 17 mm. General color dark brown in one male paratype, brownish-yellow in all other individuals examined. Surface slightly rugulose.

Head (fig. 1) with a yellow stripe along venter of about equal width throughout entire length, filling the interocular space. Dorsal surface brownish-yellow, a dark brown stripe laterally on each side of head extending from antenniferous tubercle to collum, approximately the width of an eye. A few coarse granules anteriorly on ventro-lateral surface of each side. Spiniform process between bases of antennae lacking. Labrum spiniform. Approximate proportions of rostral segments (base to tip): 11 : 10 : 12. Antenna slender, first segment with two very faint annuli; the distal three segments without markings. Approximate proportions of segments (base to tip): 27.5 : 21 : 1 : 8.8.

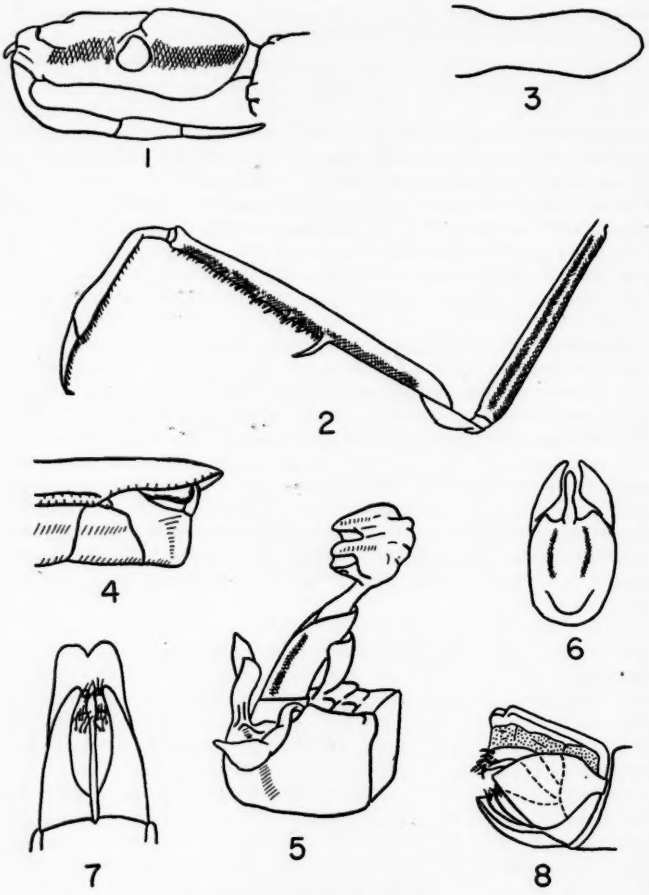
Pronotum not overlapping mesonotum in apterous form. Wing pads scarcely evident. Winged form unknown. Mesothorax and metothorax each with a ventro-median keel between bases of coxae. Prothoracic leg (fig. 2) lacking annuli; coxa and femur each with ventral and lateral longitudinal brown stripes. Two parallel series of spines on ventral side of femur; the basal spines of outer postero-ventral series approximately 4.3 times it own length from base of femur. Mesothoracic femur with four pale annuli on apical half, the basal three narrow, apical annulus at knee broad. Three narrow pale annuli on basal third of mesothoracic tibia. Mesothoracic femur with four pale annuli on apical half, the basal annulus indistinct; apical annulus at knee broad. Three narrow pale annuli on basal third of metathoracic tibia.

Abdominal surface covered with indictinct longitudinal rugulae; short appressed hairs sparsely covering venter. Seventh tergite (figs. 3, 4) in male somewhat narrowed posteriorly, well surpassing apex of hypopygium. Posterior portion of hypopygium yellow. Apical spine on superior posterior border of hypopygium erect; claspers curved and broadened apically (figs. 5, 6). Aedeagus as in fig. 5. Dorsal apical tergite in female notched (fig. 7); general aspect of gonopophyses as in figs. 7 and 8.

Closely related to a group from South America and the Juan Fernandez Island, recently treated by Wygodzinsky (1951), which includes *Metapterus rosascostai* Wygod., *Metapterus docilis* Wygod., *Metapterus fluminensis* Wygod., and *Metapterus argentinus* (Berg). Perhaps most closely related to *Metapterus docilis,* but *Metapterus wygodzinskyi* may be distinguished by the male hypopygium being more rounded ventro-posteriorly, the claspers more enlarged and rounded apically, no annuli on prothoracic legs, lack of a spiniform process between bases of the antennae, and other more general details.

Females examined vary from 2 to 3 mm. longer than the males.

One female, San Marcos, Texas, Oct. 18, 1950, was captured in Spanish moss in the same environment with *Empicoris errabundus* (Say), *Emesaya brevipennis brevipennis* (Say), *Zelus renardii* Kolenati, and various spiders and moths. All other individuals were collected in flood debris along the



EXPLANATION OF FIGURES

1, head, lateral view; 2, prothoracic leg; 3, seventh tergite of male, dorsal; 4, hypopygium, lateral; 5, aedeagus and genital capsule; 6, hypopygium, posterior; 7, female gonopophyses, ventral; 8, female gonopophyses, separated.

Guadalupe River, Comfort, Texas, Nov. 20, 1951, in the same environment with *Gardena poppaea* McAtee & Malloch, *Ploiaria similis* McAtee & Malloch, *Acanthocephala declevis* (Say), *Leptoglossus phyllopus* (Linné), *Myodocha serripes* Oliver, Thysanura, and various spiders, small snails, isopods, and moths.

Trivial name in honor of Dr. Petr Wygodzinsky, Instituto Medicina Regional, Tucumán, Argentina.

Holotype, ♂, United States National Museum, type catalogue no. 61515, collected in flood debris on the south bank of the Guadalupe River, ½ mile west of U. S. Highway 87 bridge, Comfort, Texas, Nov. 20, 1951, J. C. Elkins.

Paratypes, U. S. N. M., 1 ♀; Snow Entomological Collection, 1 ♀; collection of Wygodzinsky, 2 ♂ ♂, 1 ♀; in my collection, 2 ♂ ♂, 2 ♀ ♀.

Gardena messalina McAtee & Malloch, 1925, a Synonym of *Gardena poppaea* McAtee & Malloch, 1925.

In 1925, McAtee & Malloch described *Gardena poppaea* from an apterous male, Feb., 1905, J. C. Mitchell, Victoria, Texas, type catalogue no. 26733, U. S. N. M., and *Gardena messalina* from an apterous female, Victoria, Texas (no collector and date), type catalogue no. 26731, U. S. N. M.

The two species were separated due to the prothorax being sulcate in the center of the dorsum posteriorly, and the hind lobe of the prothorax being transversely wrinkled anteriorly in *Gardena messalina.* These conditions do not exist with the type of *Gardena poppaea.* Also, they were further separated by what McAtee & Malloch considered different leg markings; in *Gardena messalina* the fore femora each has a faint subapical pale band, the mid femora and tibiae each has two pale bands. Legs markings were not described for *Gardena poppaea.* To quote McAtee & Malloch, 1925, p. 72: "This is a wingless but mature specimen, which because of different leg markings is treated as a different species from *G. poppaea,* represented by a wingless male, also from Victoria".

According to Dr. Reece I. Sailer (in lit.), U. S. N. M., the types differ in leg markings only in intensity of color.

Collected by me are 12 individuals of *Gardena* as follows: 3 ♂ ♂, 2 ♀ ♀, Comfort, Texas, 11-20-51, from flood debris along the Guadalupe River; 1 ♂, 1 ♀, Gonzales, Texas, 10-19-50, from flood debris along Guadalupe River; 2 ♂ ♂, 1 ♀, Gonzales, Texas, 11-28-51, from flood debris along Guadalupe River; 1 ♂, 1 ♀, Cameron Co., Texas, 12-1-51, from nest of rat, *Neotoma.*

Also, a winged female from Commerce, Texas, 7-30-49, Pitman, in my collection.

Five additional individuals from the collection of Dr. James A. Slater, Ames, Iowa, have been seen and are as follows: 3 ♂ ♂, Harlingen, Texas, 5-1-45, D. E. Hardy, from the nest of rat, *Neotoma micropus;* 1 ♀, Laguna Madre, Texas, 4-18-45, D. E. Hardy, from the nest of rat, *Neotoma micropus;* one individual with terminal abdominal segments missing, Harlingen, Texas, D. E. Hardy, from the nest of rat, *Neotoma micropus.*

Among both sexes of the above mentioned insects, the annuli on the mid femora and mid tibiae vary from one annulus on each to two well defined

annuli on each. The previously mentioned conditions of the prothorax are also quite variable among both sexes.

The genitalia in both sexes are constant and agree with the type specimens.

The winged female from Commerce, Texas, has the pronotum overlapping the mesonotum to the bases of the wings, but the genital tergites agree with those of the other female specimens.

Gardena poppaea has priority over *Gardena messalina* due to being mentioned first in McAtee & Malloch's revision (1925); it is first mentioned in the key to the males on page 68.

Acknowledgements

I wish to thank the following for aid in preparing this paper: Dr. Reece I. Sailer, U. S. N. M., Washington, D. C., for comparing some of the above mentioned individuals of *Gardena* with the types of *Gardena poppaea* and *Gardena messalina;* Dr. Petr Wygodzinsky, Instituto Medicina Regional, Tucumán, Argentina, for examining several specimens of *Metapterus wygodzinskyi* and confirming their status as comprising an undescribed species.; Dr. James A. Slater, Iowa State College, Ames, Iowa, for lending me individuals of *Gardena* in his personal collection.

BIBLIOGRAPHY

McAtee, W. L. & J. R. Malloch, 1925. Revision of the American bugs of the reduviid subfamily Ploiariinae. Proc. U. S. Nat. Mus., 67 (1): 1-135, 9 pls.

Wygodzinsky, P., 1950. Sôbre o gênero *Metapterus* Costa, 1860, com notas sôbre outros Emesinae neotropicais (Hemiptera). Rev. Ent. Rio de Jan., 16 (3): 462-470, 26 figs.

———, 1951. Contribucion al conocimiento del genero *Metapterus* Costa, 1860, de las Americas y de Juan Fernandez (Hemiptera, Reduviidae). Rev. Chil. Ent., I: 113-128, 43 figs.

A NEW SPECIES OF *FANNIA* FROM NORTH AMERICA (DIPTERA, MUSCIDAE)

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The description of a new species of *Fannia* which follows is based primarily on material collected by the writer and Dr. H. R. Dodge of the Communicable Disease Center in an ecological study of the fauna of mountain summits. The name *enotahensis* refers to the fact that the majority of the type series was taken on Mt. Enotah, Ga.

Fannia enotahensis sp.n.

Blue-black, shining. Traces to *manicata* Meigen in Malloch 1924; to *monilis* Haliday in Stein 1895.

Male. Eyes bare, closely approximated, separated by about the distance across posterior ocelli; orbits blackish, silvery below; antennae black, arista short pubescent; parafacials narrow, frons black, 12 to 13 frontal bristles; palpi normal, black.

Thorax blue-black, shining, very faintly brownish-gray pruinescent in some views, non-vittate. Acrostichal setulae in three rows with the usual pair of strong prescutellar acrostichals, dorsocentrals 2:3; prealar absent. Abdomen black when viewed from above and with a whitish pruinescence when viewed from a more posterior position, markings similar to *scalaris* Fab. but more extensive. The blackish triangular marking on segments two, three, and four increase in area to cover almost the entire segment when the abdomen is viewed from a more dorsal position; the dorsal marking linear on segment five; fifth sternite concave posteriorly; hypopygium small, not protruded.

Legs black with the exception of the fore tibiae basally and fore femora apically which are reddish. Fore coxa with one stout spine postero-apically, fore femur with the usual bristles, fore tibia with one pre-apical dorsal bristle, and a preapical fan-like tuft of setae ventrally. Middle coxa with a single stout spine, the apex of which is rectangularly bent backwards. Middle femur anteroventrally with a row of 10 to 12 bristles beginning at base and ending ¼ from apex, the last five of which are closer set and stronger, in addition on apical 1/5 a comb-like row of seven or eight short, rather fine bristles; posteroventrally a row of bristles which becomes compound and more dense at shortly past middle and ends at apical 1/5. Middle tibia somewhat distinctly thickened slightly past middle, the ventral pubescence short but distinct; with one preapical dorsal bristle, one anterodorsal bristle at apical ¼, and one posterior bristle at apical 1/3. Posterior coxa with one or two bristles behind; posterior femur with a row of 13 to 15 anteroventral bristles, the basal 10 or 11 hardly longer than the surrounding setae, the apical three or four progressively stronger; posteroventrally with a row of 10 or 11 hair-like bristles which become progressively shorter from base to ¼ before apex. Posterior tibia with one preapical and one submedian dorsal

bristle; a row of 15 to 17 anterodorsal bristles, which are as long as twice the diameter of the tibia at its greatest width; a row of 14 to 15 anteroventral bristles of about the same length as the anterodorsals; posteroventrally and posterodorsally without outstanding bristles. All tarsi simple.

Wings deeply infuscated. Squamae blackish, the lower lobe protrudes. Halters yellow.

Female. Very similar in color and structure to *manicata* Meigen to which it traces in Malloch's 1924 key to females of the Nearctic species of *Fannia.* It differs in size, being somewhat smaller, and in having a distinct row of anterodorsal bristles on posterior tibiae which are but slightly smaller than the usual strong, submedian bristle. In *manicata,* there is a similar row of anterodorsals which are distinctly smaller, approximately one-half the length of the strong submedian anterodorsal bristle. The anteroventral bristles of posterior tibia usually number six or seven in *enotahensis* and only three or four in *manicata;* however, in the type series of *enotahensis,* there are a few females which have only four anteroventral bristles. The squamae and wings are not deeply infuscated as in the male.

Length, 4 to 5 mm.

Holotype, male; allotype, female, Mt. Enotah (Brasstown Bald), Towns and Union Counties, Ga., August 20, 1952 from a carrion-baited fly trap. Type No. 61793, U. S. National Museum.

Paratypes: six males, ten females, Rabun Bald, Ga., August 2 to October 24, 1952 (fly trap); 24 males, 25 females, Mt. Enotah (Brasstown Bald), Ga., August 1 to October 23, 1952 (fly trap); two males, Jacksonville, Vt., June 10, 1952 (fly trap, H. D. Pratt); two males, Razorback Lake, Wis., July 3, 1951 and July 1, 1952 (fly trap, H. B. Dodge).

Fannia enotahensis traces to *manicata* Meigen in Malloch's key, differing from *manicata* in size and in having no outstanding row of posteroventral bristles on posterior tibia. In Stein's 1895 key, it traces to *monilis* Haliday which it most closely resembles. It differs in having the squamae very dark and in the bristling of the posterior legs. In *monilis,* the anteroventral and posteroventral bristles of posterior femur are stronger than in *enotahensis.* The anteroventral row of bristles of the posterior tibia are less numerous in *monilis,* only five to seven. The dorsal triangular abdominal markings of *monilis* are smaller and more clearly defined.

REFERENCES CITED

Malloch, J. R. 1924. Exotic Muscaridae XII. Ann. and Mag. N. Hist., Ser. 9, *13*:409-424.

———, 1924. Exotic Muscaridae XIV. Ann. and Mag. N. Hist., Ser. 9, *14*:513-522.

Stein, P. 1895. Die Anthomyidengruppe Homalomyia. Berliner Entom. Zeitsch., *40*(1): 1-141.

NOTES ON THE HIBERNATION AND NESTING OF THE WASP *MISCHOCYTTARUS FLAVITARSIS* (DE SAUSSURE) (Hymenoptera, Vespidae)*

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This paper has been prepared in order to present the results of two years' observations of the bionomics of *Mischocyttarus flavitarsis flavitarsis* (de Saussure). Since little biological information is available on this or any other species of the genus, it is hoped that the present paper will prove useful even though the data are fragmentary. All observations were made on colonies found in the area of Turlock, Stanislaus County, California.

Mischocyttarus flavitarsis flavitarsis is one of the commonest wasps in certain parts of California and is quite a familiar sight on most collecting trips in the San Joaquin Valley. It seems to be particularly common in the Turlock area, where it makes its appearance in the latter part of March and remains abundant until mid-October. The latest date for nonhibernating individuals is October 23, on which date a worker was found in a clump of grass where she was apparently hunting for insects. Numerous females, however, may be taken on any warm winter day when they temporarily leave their hiding places to fly in the sun. For example, on November 11, nine females were taken; on November 12, six females; on December 5, one female; on December 15, seven females; and on January 1, 83 females and workers.[1] On November 11, a male was taken in flight and this sex may be taken in hiberation with the females as late as December 15. There is, however, no indication that males survive the winter, although it is very possible.

Favored places of hibernation are under loose bark (particularly that of eucalyptus and cottonwood logs) and in the attics of houses. Almost without exception *flavitarsis* hibernates in company with *Polistes apachus* de Saussure, *P. fuscatus aurifer* de Saussure, and *P. hunteri californicus* R. M. Bohart. Other places in which this wasp has been found hibernating are: under logs and rocks, in rotten logs, under leaves on the ground, in crevices among rocks or in the ground, in deserted rodent burrows, in old machinery, in boxes, on old nests of *Polistes* as well as their own or in the cells of these nests (this latter on cold days only), and between books on shelves.

As Bequaert (1933, the Nearctic social wasps of the subfamily Polybiinae, Ent. Amer., n.s., 13:87-150) has indicated, the nests of this species are similar to those of *Polistes* but are usually smaller. During one summer, a total of 23

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* Contribution No. 820, Department of Entomology, University of Kansas.

[1] The day of January 1, 1952 was rather warm, and many vespids were taken. *Polistes* and *Mischocyttarus* were particularly active. A total collection of some 500 wasps was made by Mr. J. I. Stage and the writer. The *Mischocyttarus* was apparently represented by workers as well as females (queens). Many of the wasps were quite small and may have been workers that emerged late in the season and went into hibernation alongside their sexually mature and fertile sisters. On the other hand, it may well be that these "workers" were fertile and should be called small queens.

inhabited nests were located. Most of them (16) were found in the latter part of August, by which time only a few of them had attained the size of *Polistes* colonies of the same age. The largest was taken on September 15, and was under a large piece of eucalyptus bark. It consisted of 257 cells, and contained two queens (both old, with frayed wings), 57 workers, and 75 males. Several additional workers and males and four more females, presumed to be queens by their large size, emerged later. Observations of other nests indicate that while some contain only one queen, two queens appear to be the rule. In spring two queens have often been seen on small nests. Of the 23 nests referred to above, one was in a cavity under a stone (enlargement of the cavity by the wasps was observed), two were under boards, six were in dense brush nine inches to five and one-half feet above the ground, and the remaining 14 were all located under the loose bark of eucalyptus trees. No doubt a wider search would have revealed many more nests, 20 of the above having been taken within a circle of approximately 500 feet radius. Thus, the extreme abundance of this wasp seems to lie not in large colonies, but rather in many small colonies scattered over a small area.

Three nests under a piece of bark were of particular interest, for they were fused together in a most interesting manner. The nests were, unfortunately, several seasons old and their exact relationship remains unknown. It would be interesting to know if all three were inhabited at the same time. It seems likely, however, that all were the product of a single season, as the manner in which they were constructed suggests that they were built toward one another. Two other fused nests have been found, one being suspended from the center of the other. This latter condition is an occasional occurrence in *Polistes* of the same area.

The feeding habits of this wasp have long remained obscure, and until now no adults have been reported as having visited flowers. In the author's collection there are five floral records; in all cases the wasps were beyond a doubt feeding on the flowers. The flowers were, *Melilotus indica, M. alba,* and *Helianthus bolanderi.* The larval food is rather varied, but seems to consist mainly of masticated flies and caterpillars, and so is rather similar to the food given to *Polistes* larvae. For additional food, the foragers visit meat, fresh hides, fish and once a queen was seen to remove a larval *Polistes* from the nest in the owner's absence. Whether or not this is a common practice is not known, although many authors have reported it in certain oriental *Vespa.*

The temperament of the wasps is, as a rule, one of mildness. They are less prone to attack than are most *Polistes.* There were a few instances, however, in which the wasps readily attacked. In these few cases, the writer had pulled away the surrounding brush in preparation for the taking of the nest. In most instances they flew at the face and hands, hitting, but not stinging, as though they rely upon merely frightening the foe. The writer was stung but twice, both times while collecting a single nest; the stings were painful only for a few moments. It is interesting that the only belligerent wasps were nesting in bushes, while those that nested under bark seemed more timid and confined their show of displeasure to flying about the nest or buzzing angrily while upon it. On no occasion would they attack. Some crawled under the bark and no amount of blowing or jabbing would induce them to come out.

Blowing on the wasps on the nests caused them to fly at one's face, but did not cause stinging or even hitting.

The writer is indebted to Dr. C. D. Michener for aiding in the preparation of this paper.

NEW DISTRIBUTION RECORDS FOR MEMBRACIDAE (Homoptera)*

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The following new distribution records were noted while determining Membracidae in the Snow Entomological Collection.

Darnis lateralis Fabricius ..... Paraguay
Entylia gemmata Germar ..... Peru
Heteronotus strigosus Butler ..... Peru
Oeda hamulus Stal ..... Peru
Publilia erecta Plummer ..... United States (Arizona)
Smerdalia horrescens Fowler ..... Mexico (San Luis Potosi)
Telamonanthe pulchella Ball ..... New Mexico, Arizona
Tylocentrus quadricornis Funkhouser ..... Utah
Tylocentrus reticulatus Van Duzee ..... California
Umbonia gladius Fairmaire ..... Yucatan

Funkhouser has reported the following from the "United States". The first two are not widely distributed in this country, and are known to me only from the states indicated. The third is generally distributed in the United States but has apparently never been reported specifically from Kansas and is therefore new to the list of this state.

Hypsoprora nogalata Ball ..... Arizona
Umbonia crassicornis Amyot & Serville ..... Florida
Vanduzea arquata Say ..... Kansas

The following was reported from Arizona by Lawson in his Membracidae of Kansas (1922), but since this record was omitted by Funkhouser in Genera Insectorum, Fascicle 208, Family Membracidae (1951), it is here repeated.

Telamonanthe rileyi Goding ..... Arizona

* Contribution No. 805 from the Department of Entomology, University of Kansas.
** Now at the University of California, Berkeley.

A NEW PINNING UNIT[1]

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University of Arkansas, Fayetteville

A new type of pinning unit is used at the University of Arkansas which performs all the functions of the conventional tray, is easier to handle and store, can be constructed at less expense and presents as good an appearance.

The commonly used pinning tray is essentially a rectangular, cardboard box with a cork pinning surface in the bottom. It provides protection for the specimens within, keeps them distinctly separated from other specimens and facilitates addition to, and rearrangement of, the species. Despite its apparent simplicity, it is one of the most expensive items in the museum.

The Arkansas pinning unit is basically a pinning tray with the front and both sides removed. Since there are no sides or front to the pinning unit, the dorsal and posterior parts of all specimens may be examined under binoculars, and the lateral parts of the two end specimens grossly, without removing them from the unit. The accessibility of the pinning surface lessens the danger of breakage while placing insects on the unit or removing them from it, particularly if forceps must be used. When the pinning unit is out of the drawer the specimens are not as well protected as they are by the pinning tray. Greater care must be exercised in removing the units from, and placing them in, the drawer.

The new unit consists of three pieces. A one-eighth inch masonite base is fastened to a three-sixteenth inch white pine upright with glue and three small brads. A pinning surface of one-quarter inch balsa is glued to the masonite and to the upright along one edge. Dimensions are intentionally omitted because the inside measurements of Cornell drawers and U. S. National Museum drawers are different and some museums have drawers that do not conform to either of these standards. It is convenient to have units of four sizes of such dimensions that, when placed in four rows, eight, sixteen, thirty-two and forty-eight units will fill a drawer. It will be noticed that three of the smallest units will replace two of the next largest size. Units with a smaller base were found to be unstable.

Cardboard dividers are used between the rows of pinning units and, in the case of Cornell drawers, a fumigant holder replaces one of the units. The fumigant holder is made by omitting the balsa from a pinning unit and glueing a cardboard box to the base and upright. It is fastened to the drawer by thumb tacks at the front and one side.

An account has been kept of the cost of making 1400 small units, 960 of the next larger size and 160 of the second larger size—a total of 2560 units. The figures given below are the average cost of a unit based on this entire lot. They are not broken down according to unit size. The larger units require more masonite and balsa but take less time to assemble. The cost of material (except balsa) and of sawing all material was 4½ cents, balsa cost 1½ cents

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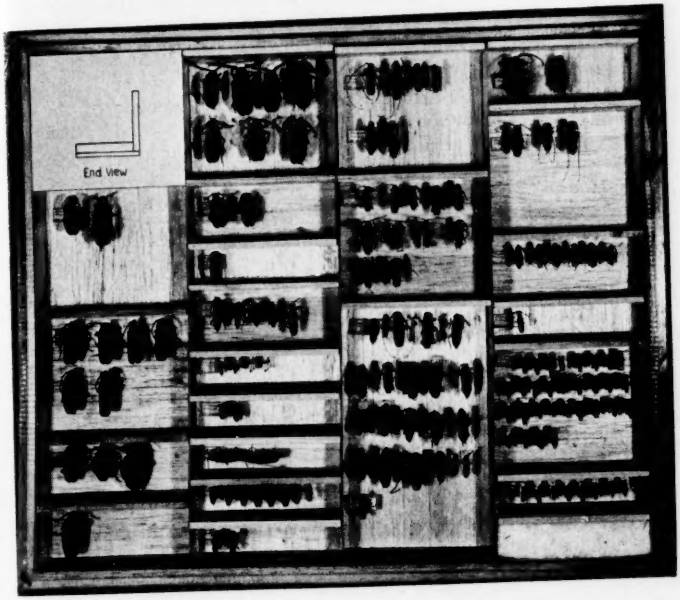
[1] Research paper No. 1085. Journal Series, University of Arkansas. Published with the permission of the Director of the Arkansas Agricultural Experiment Station.

and assembling, brads and glue cost 2 cents—a total of 8 cents. The pieces were cut by a cabinet maker, at three dollars an hour, and assembled by students. By using student labor entirely the cost can be further reduced.



A REVISION OF THE NEARCTIC GENERA OF ELMIDAE (Coleoptera)

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The present classification of United States and Canadian aquatic beetles of the family Elmidae is the result of a correlated study of adult and larval stages. In spite of the fact that few of our genera have been reared, the larval and adult stages of many species have been definitely associated by means of a process of association and elimination. At first this method may appear to be unreliable, but extensive testing has convinced me of its reliability if used with proper caution.

The solution to the question of association was the collection of pure cultures of single genera and species. For example, collections in marl in a Michigan lake produced nothing but adults and various larval stages of *Stenelmis quadrimaculata* Horn. Again, *Dubiraphia quadrinotata* Say was the only elmid found in overflow strip pit ponds near a river in Eastern Illinois and no other genus except a representative of *Optioservus* was found in a small stream in Northern Illinois. With these associations and others established, and with the determination of their generic characteristics, it was then possible to recognze larvae of these genera in mixed collections from streams or other bodies of water. By slow degrees the larvae of 21 of our 22 genera were associated with their adults. The time seems imminent for the final chapter of an arduous but exciting story.

It would be a breach of probity not to acknowledge the help which I have derived from several sources chief among which are the many works of Hinton dealing particularly with the Neotropical fauna. They have been especially valuable in the recognition of several larval genera occurring in the Southwest, and from them I have drawn illustrations and descriptive material for certain genera of which no larvae were available to me for study. To many friends unlisted here but unforgotten, I am also grateful for supply-useful associations and for confirming others of which I had remained in doubt. Use was also made of the works of West (1927), Böving and Craighead (1930), and Bertrand (1939) involving the determination of elmid larvae.

Faunal Affinities

Of the 22 Nearctic genera recognized, ten are indigenous to the United States and several of these extend their ranges into Canada. Six of the ten genera (*Ordobrevia, Ampumixis, Cleptelmis, Narpus, Lara,* and *Heterlimnius*) are confined to the western states, two genera (*Dubiraphia* and *Optioservus*) are transcontinental, and two genera (*Promoresia* and *Gonielmis*) occur only in the East and Southeast. Seven of the remaining twelve genera (*Phanocerus, Cylloepus, Elsianus, Neoelmis, Heterelmis, Microcylloepus* and *Hexacylleopus*) are northern extensions of a larger Mexican and Tropical American fauna and are distributed chiefly in the Southwest. The remaining five genera occur also in the Old World. Of these *Stenelmis* is the most widely distributed over the world, having species represented on all continents except

South America. This is the largest genus in the United States nearly all of the species occurring east of the 100th meridian. *Macronychus* has a single widely distributed species in the eastern half of the United States, and there is one species each in Europe and India. *Zaitzevia* is chiefly Oriental in distribution and is confined to the West in North America. *Limnius,* a conspicuous Palaearctic genus, has one or two New World species confined to the Appalachian Mountain area. Perhaps the most curious distribution pattern is that of *Ancyronyx* in which one species occurs in the Eastern United States, one in northern South America, and several species in the Oriental Region and Africa.

More than one-half of the species of Elmidae in the Nearctic Region were described in the genus *Elmis* Latreille (=*Helmis*). This genus, as at present restricted, is not known to occur in the United States and Canada but has many species in the Old World. The Australian *Simsonia* Carter and Zeck also appears to be absent from the Nearctic Region, and a new genus is proposed for species formerly assigned to it.

Family Relationships and Phylogeny

Before the relationships of the various Dryopoid families and genera are well understood, it will be necessary to examine the world fauna. Many adult genera have not been studied in detail, and the larvae of various genera remain to be discoveerd and studied. Nevertheless the study of the Nearctic fauna in several families of Dryopoidea has suggested some phyletic affinities among the Elmidae, Limnichidae, and Dryopidae. The following key will outline a few of the important larval and adult characteristics of three closely related aquatic and semiaquatic families.

Synopsis of three families of Dryopoidea

A. *Larva*: Three tufts of rectractile anal gills bearing slender filaments; a pair of internal hooks attached to an abdominal operculum (fig. 43); 1 to 3 thoracic pleura (figs. 34, 40, 48), 6 to 9 abdominal pleura (figs. 36, 63); last abdominal segment (figs. 52, 60) slightly to deeply emarginate; aquatic, living submerged: *Adult*: Anterior coxa usually round, generally without an exposed trochantin; antenna usually slender; eyes without hairs; female genitalia composed of paired coxites, each bearing a terminal jointed stylus; aquatic and semiaquatic ..... *Elmidae*

AA. *Larva*: Three tufts of rectractile anal gills; 1 thoracic pleuron, 4 abdominal pleura; last abdominal segment rounded at apex; aquatic. *Adult*: Anterior coxa transverse as in fig. 2, with a well developed trochantin; antenna short, as in fig. 3, most segments broad; eyes hairy; female genitalia of the ovipositor type, without styli; semiaquatic, living close to water's surface but generally not submerged ..... *Limnichidae*

AAA. *Larva*: Without tufted and filamentous retractile anal gills; first five abdominal sternites with ventral fold; operculum present; pleura not well developed; aquatic and semiaquatic,

sometimes found in moist fields. *Adult*: Anterior coxa (fig. 2) transverse, trochantin well developed and exposed; antenna (fig. 3) short, most segments broader than long; female genitalia of the ovipositor type, without styli; aquatic and semiaquatic ..... *Dryopidae*

In my 1938 key to the United States genera of Dryopidae, the Elmidae, as now restricted, was treated as one of three subfamilies, the Elminae. Hinton (1940) presented evidence to show that *Phanocerus* and *Lara,* placed by me in the Larinae, should be included in the Elmidae. *Lutrochus* and *Throscinus,* which I placed in the subfamily Dryopinae, were referred by Hinton (1939b) to the new family Limnichidae, leaving *Dryops, Helichus,* and *Pelonomus* the only Nearctic genera now recognized as belonging to the Dryopidae. The Chelonariidae, with one of the numerous New World species of *Chelonarium* found in Florida, was not included in my study for it was considered as a distinct family from my "Dryopidae". However, the possession by the *Chelonarium* larva of retractile anal gills indicates a close phyletic relationship of the Chelonariidae to the Elmidae and Limnichidae. The adult, compared with Elmidae and Limnichidae, is more highly specialized in its tarsal structure, having the third segment strongly lobed, and the claw broadly dilated at base. The head and legs are strongly retractile. It is recorded as living on the leaves of plants. It appears probable that the Chelonariidae have branched from the elmid-dryopid stem near the Elmidae and Limnichidae, and that the adult has specialized independently from its aquatic larva in its adaptation to a more terrestrial life.

Study of the adults and most of the larvae of the Nearctic genera of Elmidae, Limnichidae, and Dryopidae suggests that the Elmidae may be the most primitive. This belief is based primarily on the generalized type of female genitalia in the Elmidae, this structure consisting of paired coxites each of which bears a terminal jointed stylus. Females of the Limnichidae and Dryopidae have no terminal styli but possess narrow ovipositors apparently adapted for inserting eggs into plant tissues.

Phanocerus and *Lara,* having the only known semiaquatic adults among Nearctic Elmidae, together differ strikingly in general appearance from other Elmidae by having the body very finely and closely punctured, with very fine closely placed hairs. The absence of flat tomentum is another characteristic of these genera. Their larvae, however, have basically different prosternal structures, *Phanocerus* having a well developed prothoracic posterior sternum (fig. 36), which is absent in *Lara.* The presence of the posterior sternum in *Phanocerus* associates it phyletically with *Ancyronyx* and allied genera, and it is believed that this group of genera could have been the first line to branch from the elmid-dryopid stem. *Lara,* without a posterior sternum in the larva and with several adult features similar to *Phanocerus,* possibly branched off as the second line. The third line, containing *Macronychus* and associated genera, has no larva with a posterior sternum, and all adults are aquatic. This phyletic arrangement of three branching elmid lines argues against the segregation of *Phanocerus* and *Lara* as a subfamily or tribe but admits that they possibly branched off separately and close to the main elmid-dryopid stem and have retained some primitive ancestral features.

Phanocerus and *Lara* adults each have a long pointed prosternum which fits into a deep mesosternal groove. This feature is also characteristic of the limnichids and dryopids, but it is believed that it has been of independent origin in *Phanocerus* and *Lara*. The elmid type of genitalia and the 3-branched anal gill in these two genera are considered to be of greater phylogenetic significance for associating them with Elmidae rather than with the Limnichidae or Dryopidae.

The Limnichidae, represented by *Lutrochus,* has a more specialized adult than the Elmidae but the larva still retains one important elmid characteristic, the three-branched anal gill. The dryopid adult is similar in nearly all features to *Lutrochus,* but the Nearctic representatives are more elongate, the female ovipositor is more heavily sclerotized, and they are not exclusively semiaquatic but some species apparently remain submerged in water for long periods. The larva of the Dryopidae (West, Böving & Craighead, and Peterson have erroneously figured the larva of *Ectopria* in the Psephenidae as *Helichus,* a representative of the Dryopidae) has no opercular hooks nor three-branched anal gills as in the Elmidae and Limnichidae, the thoracic and abdominal pleura are poorly developed, and the first 5 abdominal sternites are deeply folded. These features appear to indicate regressive specialization of the simpler elmid larval structures and suggest that the Dryopidae have reached a higher evolutionary level than the Elmidae and Limnichidae.

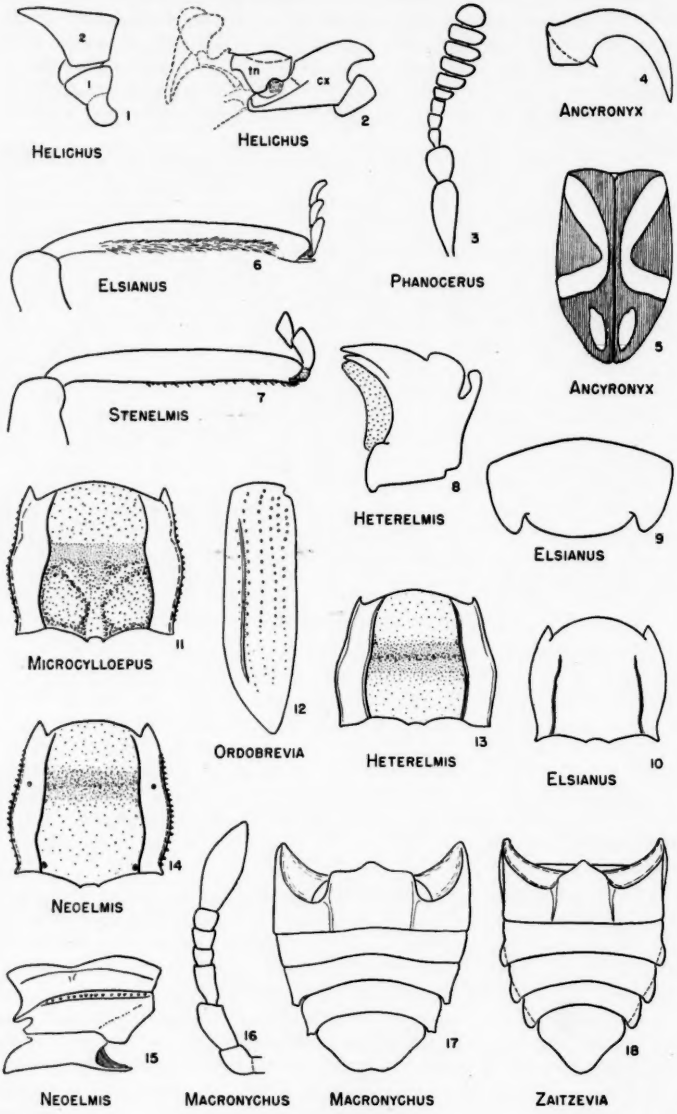
The foregoing outline, and the descriptive notes to follow, mention but few of the family and generic characteristics that have been used for their segregation. Hinton has described other important features of various genera in these families, including types of wing venation, larval mouthparts, details of larval body hairs, and various systems of their internal anatomy.

Generic and Species Treatment

The generic treatment consists of keys to the adults and to the larvae followed by a brief discussion or a description of each genus. Under each genus is a list of the Nearctic species and subspecies with citation to the original description. The genus in which each was described (generic names omitted if described in genus now placed), and the general area from which it was described or in which it is known to occur, are given. These areas are indicated briefly as E. for East, W. for West (areas west of 100th meridian), SW. for Southwest including Texas, and Tr. for transcontinental. Little of the published synonymy is indicated for it is doubtful that is should be accepted before a revisional study is made.

Those unfamiliar with some of the genera or generic groups in the keys to follow may find it necessary to study larvae and adults in alcohol or to treat representative adult specimens in potassium hydroxide in order to examine clearly mouthparts, the number of antennal segments for certain genera, condition of the mandibles, and some pronotal features.

Much use has been made in the larval key of the ventral thoracic structures, especially the number of parts into which the propleuron, mesopleuron, and metapleuron are divided. The propleuron may consist of one, two, or three parts (figs. 34, 50, 65). If there are three parts separated by a suture from the lateral margin of the prothoracic tergite. (fig. 65), the anterior part


2
1
1
HELICHUS
tn
cx
2
HELICHUS
3
PHANOCERUS
4
ANCYRONYX
6
ELSIANUS
5
ANCYRONYX
7
STENELMIS
8
HETERELMIS
9
ELSIANUS
11
MICROCYLLOEPUS
12
ORDOBREVIA
13
HETERELMIS
10
ELSIANUS
14
NEOELMIS
15
NEOELMIS
16
MACRONYCHUS
17
MACRONYCHUS
18
ZAITZEVIA

may also involve the anterior sternum, the large sclerite anterior to the coxa. In this report the propleuron is treated as consisting of the prepleurite (fig. 66) which if present is always a single piece, and the postpleurite (fig. 66) which may have one or two parts. If the postpleurite is described as having two parts then these together with the prepleurite will have three parts adjacent to the lateral suture.

In some larval genera, behind the anterior coxae, lies the posterior sternum (fig. 34), separated from the pleura by a suture. The presence or absence of this sclerite is a useful character in generic determination, also a phyletic indicator. The mesopleuron and metapleuron may likewise have one to three parts as shown in figs. 48, 62 and 70.

Some features of the adult abdomen are useful in generic diagnosis, and in this report the visible sternites are numbered from 1 to 5. Two types of tomentum or pile are referred to in the descriptions, one a flat silky mat covering parts of the head, thorax, abdomen and elytra of some genera, the other type consisting of erect or semierect hairs found on the tibiae and femora in most of our genera. These are referred to as flat tomentum and hairy tomentum.

Key to Nearctic Genera of Elmidae
Adults

1. Antenna (fig. 3) 11-segmented, very short, strongly clubbed, segments 6 to 10 two to three times wider than long; body densely hairy above; length 2.5 to 3.5 mm. ..... *Phanocerus* Sharp
   Antenna usually slender, usually 10 or 11-segmented but with some segments wider than long if only 7 or 8-segmented 2
2. Body densely hairy above; length about 5 to 8 mm. ..... *Lara* LeConte
   Body at most thinly hairy above; length not over 4 mm. 3
3. Tarsal claw (fig. 4) with a small basal tooth; basal elytral spot (fig. 5) angulate near suture. ..... *Ancyronyx* Erichson
   Tarsal claw without basal tooth 4
4. Anterior tibia (fig. 7) without fringe of tomentum 5

PLATE I, ADULTS OF DRYOPIDAE AND ELMIDAE

Fig. 1. Helichus lithophilus Germar. Left antenna, two basal segments.
Fig. 2. Helichus lithophilus Germar. Right coxa (cx) and trochantin (tn).
Fig. 3. Phanocerus clavicornis Sharp. Antenna.
Fig. 4. Ancyronyx variegatus Germar. Tarsal claw.
Fig. 5. Ancyronyx variegatus Germar. Elytra.
Fig. 6. Elsianus texanus Schaeffer. Anterior tibia.
Fig. 7. Stenelmis sp. Anterior tibia.
Fig. 8. Heterelmis sp. Right mandible.
Fig. 9. Elsianus texanus Schaeffer. Last abdominal sternite.
Fig. 10. Elsianus texanus Schaeffer. Pronotum.
Fig. 11. Microcylloepus sp. Pronotum.
Fig. 12. Ordobrevia nubifera Fall. Left elytron.
Fig. 13. Heterelmis sp. Pronotum.
Fig. 14. Neoelmis caesa LeConte. Pronotum.
Fig. 15. Neoelmis caesa LeConte. Prothorax, lateral view.
Fig. 16. Macronychus glabratus Say. Antenna.
Fig. 17. Macronychus glabratus Say. Abdomen.
Fig. 18. Zaitzevia sp. Abdomen.

Anterior tibia (fig. 6) with fringe of tomentum 6

5. Second elytral stria (fig. 12) incomplete, terminating at about basal 1/5 ..... *Ordobrevia* n. gen.
Second elytral stria complete, extending nearly to elytral apex ..... *Stenelmis* Dufour

6. Last abdominal sternite (fig. 9) produced on each lateral margin as a distinct lobe 7
Last sternite straight, slightly emarginate or nearly evenly convex on lateral margin as in figs. 18 and 30 12

7. Second elytral stria incomplete, terminating at about basal 1/5; elytron without longitudinal carinae; pronotum (fig. 10) with a complete or nearly complete but sometimes faint carina between meson and lateral margin ..... *Elsianus* Sharp
Second elytral stria nearly complete to apex of elytron; elytron with one or more longitudinal carinae 8

8. Each mandible (fig. 8) with a narrow lobe on lateral margin 9
Mandible without narrow lateral lobe 10

9. Pronotum (fig. 13) transversely depressed at middle .... *Heterelmis* Sharp
Pronotum (fig. 11) transversely depressed at anterior 1/3 or 2/5 ..... *Microcylloepus* Hinton

10. Pronotum (fig. 14) transversely depressed at or slightly before middle, with a deep fovea at each end of depression outside lateral carina, and another fovea on inside of carina near base; a serrate carina (fig. 15) parallel to lateral margin ..... *Neoelmis* Musgrave
Pronotum not conspicuously transversely depressed, without a serrate carina near lateral margin and without foveae 11

11. Prothoracic hypomera with a complete transverse band of flat tomentum; last two rows of elytral punctures between lateral carina and lateral elytral margin confused and indistinct so that the elytron appears to have but seven complete rows ..... *Hexacylloepus* Hinton
Prothoracic hypomera without a complete band of flat tomentum; nine distinct rows of elytral punctures ..... *Cylloepus* Erichson

12. Antenna 7 or 8-segmented 13
Antenna 10 or 11-segmented 14

13. Antenna (fig. 16) 7-segmented; posterior coxae midely separated by a quadrate lobe (fig. 17) of the first abdominal sternite; length 2.5 to 3.5 mm. ..... *Macronychus* Müller
Antenna 8-segmented; posterior coxae more narrowly separated by the more pointed lobe (fig. 18) of the first abdominal sternite; length about 2 mm. ..... *Zaitzevia* Champion

14. Antenna 10-segmented; pronotum (fig. 19) with a short basal carina between meson and lateral margin ..... *Heterlimnius* Hinton
Antenna 11-segmented 15

15. Maxillary palpus 3-segmented as in fig. 20 16
Maxillary palpus 4-segmented 19

16. Body (fig. 21) very minute, about 1 mm. in length; each side of pronotum with a distinct carina extending full length of pronotum ..... *Limnius* Erichson

Body larger, measuring 1.5 mm. or more in length 17

17. Pronotum (fig. 24) evenly punctured, without carinae or swellings; length 3 to 4 mm. ..... *Narpus* Casey
Pronotum with sublateral carinae or swellings 18

18. Pronotum (fig. 23) with a very narrow carina or depression at middle; side of pronotum behind anterior angle longitudinally excavated; prosternal ridge (fig. 22) perpendicular to anterior margin of prosternum and joining anterior margin of coxal cavity ..... *Ampumixis* n. gen.
Pronotum (fig. 25) without median carina or depression; side of pronotum not excavated; prosternal carina arising on inner margin of coxal cavity and extending obliquely nearly to anterior margin ..... *Cleptelmis* n. gen.

19. Pronotum without distinct basal carinae 20
Pronotum with a short sublateral carina in basal ¼ to ½ 21

20. Pronotal disc (fig. 26) entirely smooth; prosternum (fig. 29) with a faint oblique carina on each side not reaching anterior margin; elytral spots, if present, longitudinal or circular ..... *Dubiraphia* n. gen.
Pronotum (fig. 28) with a faint rugose area at base between meson and posterior angle; prosternum (fig. 32) without carinae; elytral spots (fig. 31) oblique ..... *Gonielmis* n. gen.

21. Lateral margins of prothorax (fig. 33) slightly serrate, posterior margin with many small closely placed teeth; posterior prosternal lobe broadly rounded at apex as in fig. 32 ..... *Optioservus* n. gen.
Lateral and posterior margins of prothorax (fig. 27) smooth; posterior prosternal lobe more triangular in outline and less rounded at apex than shown in fig. 32 ..... *Promoresia* n. gen.

Key to Nearctic Genera of Elmidae
Larvae

1. Prothorax with a posterior sternum (fig. 34) behind the middle coxae, usually separated from lateral pleural sclerite by a distinct suture 2
Posterior sternum absent as in fig. 65 10

2. Eight complete abdominal pleura on each side of venter as in fig. 36. 3
Seven abdominal pleura on each side 4

3. Body depressed (fig. 35), the lateral margins of the thoracic segments and the first 8 abdominal segments produced into curved flattened lobes; 2 mesothoracic and 2 metathoracic pleurites (fig. 36); propleuron of 2 parts ..... *Phanocerus* Sharp
Body cylindrical (fig. 64), the lateral margins of thoracic and abdominal segments not produced; propleuron, mesopleuron, and metapleuron each of 1 part ..... *Cylloepus* Erichson

4. Front of head at each antero-lateral angle produced as in fig. 39 5
Front of head not produced 8

5. Abdominal segments 2 to 7 each with tergal (dorso-lateral) su-

19

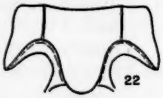
HETERLIMNIUS

20

NARPUS

21

LIMNIUS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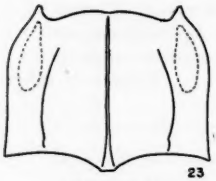
AMPUMIXIS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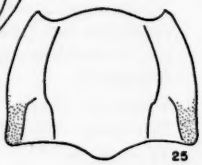
AMPUMIXIS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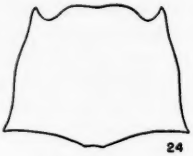
CLEPTELMIS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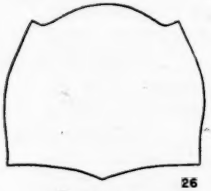
NARPUS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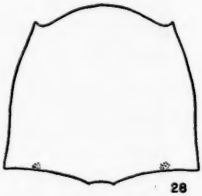
DUBIRAPHIA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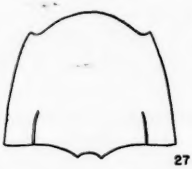
GONIELMIS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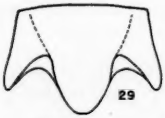
PROMORESIA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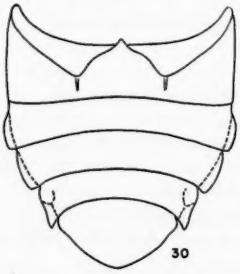
DUBIRAPHIA

32

GONIELMIS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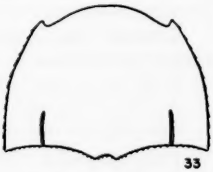
OPTIOSERVUS

31

GONIELMIS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OPTIOSERVUS

tures; mesopleuron and metapleuron (fig. 40) each of 2 parts 6
Abdominal segments without tergal sutures 7

6. Propleuron of 1 continuous part (fig. 34) ..... *Stenelmis* Dufour
Propleuron of 2 parts (fig. 40) ..... *Elsianus* Sharp

7. Propleuron of 2 parts as in fig. 40 ..... *Neoelmis* Musgrave
Propleuron of 1 part as in fig. 34, the prepleurite and postpleurite united to form a continuous sclerite adjoining the lateral suture ..... *Ordobrevia* n. gen.

8. Posterior angles of first 8 abdominal segments each (fig. 44) produced on lateral margin; propleuron of 1 part; mesopleuron and metapleuron each of 2 parts. ..... *Ancyronyx* Erichson
Posterior angles of abdominal segments not produced as in fig. 63; propleuron of 2 parts; mesopleuron and metapleuron each divided into 3 parts as in fig. 48 9

9. First 8 abdominal segments (fig. 47) each with 4 diagonal dorsal rows of blunt spines; mesonotal and metanotal rows similar but each lateral row divided at apical ½; last abdominal segment (fig. 45) with a median dorsal group and a lateral row of spines..... *Heterelmis* Sharp
First 8 abdominal segments each (fig. 50) with 4 irregular rows of flat tubercles; median ridge of last segment (fig. 52) with an irregular row of flat tubercles ..... *Microcylloepus* Hinton

10. Body irregularly quadrangular in cross section, the thoracic and first 8 abdominal tergites with lateral and posterior margins bearing long soft finger-like projections; mesopleuron and metapleuron each of 1 part as in fig. 70; last abdominal segment (fig. 56) deeply emarginate at apex; length of full grown larva about 15 mm. ..... *Lara* LeConte
Body more cylindrical or triangular in cross-section, the tergites without long finger-like projections 11

11. Postpleurite (fig. 58) of 1 part, the prepleurite and anterior sternum absent; pronotum (fig. 61) with two large transverse smooth areas; mesopleuron and metapleuron each of 2 parts ..... *Narpus* Casey
Postpleurite of 1 or 2 parts, the prepleurite present (fig. 66) 12

PLATE II, ADULTS OF ELMIDAE

Fig. 19 Heterlimnius koebelei Martin. Pronotum.
Fig. 20. Narpus sp. Right maxilla, palpal segments numbered.
Fig. 21. Limnius latiusculus LeConte. Dorsal view.
Fig. 22. Ampumixis dispar all. Prosternum.
Fig. 23. Ampumixis dispar Fall. Pronotum.
Fig. 24. Narpus sp. Pronotum.
Fig. 25. Cleptelmis ornata Schaeffer. Pronotum.
Fig. 26. Dubiraphia sp. Pronotum.
Fig. 27. Promoresia tardella Fall. Pronotum.
Fig. 28. Gonielmis dietrichi Musgrave. Pronotum.
Fig. 29. Dubiraphia sp. Prosternum.
Fig. 30. Optioservus trivittatus Brown. Abdomen.
Fig. 31. Gonielmis dietrichi Musgrave. Left elytron.
Fig. 32. Gonielmis dietrichi Musgrave. Prosternum.
Fig. 33. Optioservus trivittatus Brown. Pronotum.

12. Postpleurite of 2 parts as in fig. 66 13
Postpleurite of 1 part 19
13. Mesopleuron divided into 2 parts (fig. 62) 14
Mesopleuron of 1 part as in fig. 70 18
14. Six abdominal pleura; last abdominal segment (fig. 60) with two long acute narrowly separated apical processes ..... *Macronychus* Müller
Seven abdominal pleura 15
15. Last abdominal segment (fig. 57) with lateral angles of apical emargination produced, the lateral margin before angle distinctly serrate; body more evenly cylindrical in cross-section ..... *Zaitzevia* Champion
Apex of last abdominal segment very shallowly emarginate, angles not so acute as in fig. 64; body (fig. 59) more nearly triangular in cross-section 16
16. Anterior pleurite of mesopleuron and metapleuron each long and narrow averaging about ½ width of posterior pleurite; abdominal tergites tumid on meson somewhat as in fig. 69, each tumidity covered with scale-like hairs; two longitudinal dark marks on each thoracic tergite ..... *Gonielmis* n. gen.
Anterior pleurite of mesopleuron and metapleuron short and broad as in fig. 62; abdominal tergites not tumid on meson; thoracic tergites without dark markings 17
17. Length of full grown larva about 4 mm. Western states ..... *Heterliminus* Hinton
Length of full grown larva about 2 mm. Appalachian area ..... *Limnius* Erichson
18. Abdominal tergites on meson strongly humped at posterior margins, more strongly so than in fig. 69; each abdominal tergite except last with a large swelling between median hump and lateral margin; last tergite (fig. 67) slightly tumid at middle ..... *Promoresia* n. gen.
Abdominal tergites not conspicuously humped at middle and without large swellings, as in figs. 64 & 59 ..... *Optioservus* n. gen.
19. Eight abdominal segments with pleura; body (fig. 53) very slender, the last segment (fig. 54) about 4 times longer than wide; operculum (fig. 55) with apex acute ..... *Dubiraphia* n. gen.
Six or seven abdominal segments with pleura as in fig. 63 20
20. First 8 abdominal segments each (fig. 69) tuberculate at middle on posterior half; each tubercle covered with a dense group of scales; lateral surface of tergite swollen; last abdominal segment (fig. 71) strongly tuberculate on meson and with a dense group of scales ..... *Ampumixis* n. gen.
Abdominal segments not tuberculate at middle or on sides; body nearly evenly convex above ..... *Cleptelmis* n. gen.

Phanocerus Sharp

Genotype: *Phanocerus clavicornis* Sharp. Mexico. Monobasic.

One of the 7 known species, *clavicornis*, has been found in Texas. Adults

of this genus and *Lara* appear to enter the water only for oviposition. A larva from Nuevo Leon, Mexico, is figured. The larva and adult are fully described by Hinton.

Lara LeConte

Genotype: *Lara avara* LeConte. Monobasic.

This genus containing our two largest species of Elmidae occurs only in Western North America. The larva was illustrated by West (1927) and the genus was revised by Darlington (1929).

Ancyronyx Erichson

Genotype: *Macronychus variegatus* Germar. Subsequent designation.

This genus has been recorded from the Old and New Worlds, the only New World species other than *variegatus* occurring in South America. The adult is our most conspicuous representative of the family by its unique arrangement of red markings on the elytra (fig. 5). All the coxae are unusually widely separated so that the legs appear to arise from the sides of the body. This is our only United States genus having a basal tooth on each tarsal claw of the adult. Böving and Craighead (1930, plate 71) have illustrated the larva of *Dubiraphia* as *Ancyronyx*. However, the larva of *Ancyronyx* is much broader, somewhat like their figure for *Elmis aenea,* having the posterior angles of the first 8 abdominal segments (fig. 44) conspicuously produced. The larval opercular hooks of *Ancyronyx* (fig. 43) are less curved than those in many elmid genera. The last abdominal segment (fig. 46) is broadly emarginate at apex, the angles not produced.

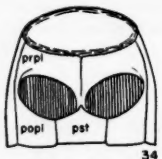
Hydrochus parumoculatus Hardy is given in the Leng Catalogue (1920) as a synonym of *Ancyronyx variegatus* but upon whose authority I do not know. It was described from an individual collected near Newcastle, England, and was believed by its describer to be an introduced foreign insect. The brief description appears to indicate a beetle quite different from *Ancyronyx,* possibly belonging to another family.

Ordobrevia new genus

Genotype: *Stenelmis nubifera* Fall

Adult. Antenna 11-segmented. Maxillary palpus 3-segmented. Pronotum with shallow median longitudinal groove extending from basal margin for ¾ length of pronotum; each side of pronotum with a longitudinal ridge at basal 1/3 near lateral margin which continues to anterior margin but is only slightly convex; surface with many small tubercles. Posternum rather long before coxae and without longitudinal carinae. Elytron with second stria incomplete and terminating at about basal 1/5. Metasternum nearly twice as long as longitudinal diameter of middle coxa and without carinae. First abdominal sternite without carinae, fourth produced at each posterior angle, fifth slightly emarginate before the truncate apex on each side of which the margin is angularly produced. Tibiae without patches of tomentum; tarsal claw without basal tooth.

Larva. Dorsum evenly convex. Prosternal region with a posterior sternum, anterior sternum, prepleurite and postpleurite all fused to form a single piece which reaches the lateral margin. Each mesothoracic and metathoracic



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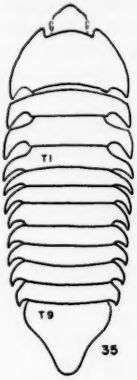
STENELMIS



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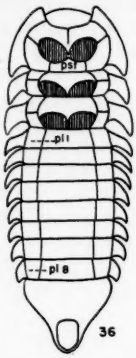

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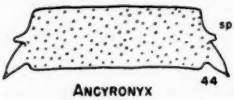

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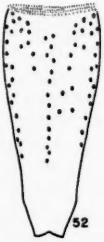
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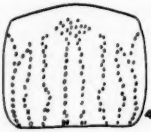
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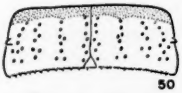
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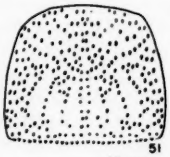
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MICROCYLLOEPUS

pleuron of two parts. Seven abdominal pleura. Last segment (fig. 42) slightly convex at apical margin and with a conspicuous projection on each side as in fig. 42. Operculum as in fig. 43. Front of head with a tooth at each lateral angle near the clypeus, as in fig. 39. Clypeus short and without a tooth on each side.

Stenelmis nubifera was treated by Sanderson (1938) as the only representative of the *nubifera* group of North American *Stenelmis*. At that time it was believed to be the only Pacific Coast representative of the genus. The study of its larva has disclosed the absence of tergal sutures which, together with certain features of the adult, appear to distinguish *Ordobrevia* generically from *Stenelmis*. The adult is similar to *Stenelmis* by having no tomentum on the tibiae but the second elytral stria is incomplete and terminates a short distance from the base.

Stenelmis Dufour

Genotype: *Elmis canaliculata* Gyllenhal. Europe. Subsequent designation.

This is a widely distributed genus in the Old and New Worlds although in the New World it appears to be confined to North America. This is the largest genus of North American Elmidae containing about 28 species. They were revised by Sanderson (1938). The larva and pupa of a species believed to be *bicarinata* LeConte were described and illustrated by Matheson (1914). Larval representatives of the genus have since been illustrated by West (1929), Böving and Craighead (1930), and Peterson (1951).

This is one of the few North American genera in which there are no patches of tomentum on the tibiae of the adults. In this feature *Stenelmis* is similar to and closely related to *Ordobrevia* although it is even more closely

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PLATE III, LARVAE OF ELMIDAE

Fig. 34. Stenelmis sp. Prosternum (pst=posterior sternum, prlp=prepleurite, popl=postpleurite).
Fig. 35. Phanocerus clavicornis Sharp. Dorsal view (t 1, t 9= tergites 1 and 9).
Fig. 36. Phanocerus clavicornis Sharp. Ventral view (pl 1, pl 8=abdominal pleuron 1 and 8).
Fig. 37. Cylloepus sp. Thoracic sternites and 1st abdominal segment (after Hinton, 1940a, p. 368).
Fig. 38. Cylloepus sp. Dorsal view, last abdominal segment (after Hinton, 1940a, p. 368).
Fig. 39. Stenelmis sp. Head showing frontal tooth.
Fig. 40. Elsianus graniger Sharp. Prosternum and mesosternum (after Hinton, 1940a, p. 279).
Fig. 41. Ordobrevia nubifera Fall. Mesosternum, pleural parts numbered.
Fig. 42. Ordobrevia nubifera Fall. Dorsal view of last abdominal segment.
Fig. 43. Ancyronyx variegatus Germar. Operculum of last abdominal segment showing internal hooks.
Fig. 44. Ancyronyx variegatus Germar. Third abdominal tergite (sp=spiracle).
Fig. 45. Heterelmis sp. Dorsal view of last abdominal segment.
Fig. 46. Ancyronyx variegatus Germar. Dorsal view of last abdominal segment.
Fig. 47. Heterelmis sp. First abdominal tergite.
Fig. 48. Heterelmis sp. Mesosternum, pleural parts numbered.
Fig. 49. Heterelmis sp. Pronotum.
Fig. 50. Microcylloepus sp. First abdominal tergite.
Fig. 51. Microcylloepus sp. Pronotum.
Fig. 52. Microcylloepus sp. Dorsal view of last abdominal segment.

similar in general appearance to *Cylloepus*. Adults may be distinguished from *Ordobrevia* by having the second elytral stria complete. Larvae of the two genera are similar, those of *Stenelmis* having tergal sutures on abdominal segments 2 to 7, these being absent in *Ordobrevia*.

The species commonly occur in streams and lakes or ponds often in large numbers. Frequently several species may occur together. They are strongly attracted to lights and it is believed that these flights probably take place shortly after adult emergence from the pupal cuticle and before they have entered the water.

Elsianus Sharp

Genotype: *Elsianus robustus* Sharp. Mexico. Monobasic.

This New World genus of some 35 species has two species recorded from our Southwest. Adults of one have been available for study but larvae of the two Nearctic species have not been described. The adults are large elmids measuring from 4 to nearly 5 mm. in length. The anterior tibia (fig. 6) has a patch of tomentum, and the pronotum of each of our species (fig. 10) has a nearly complete carina on each side extending from the posterior to the anterior margin. The second elytral stria is incomplete, as in *Ordobrevia*, but the larger size and the presence of tibial tomentum will readily distinguish *Elsianus*. Hinton (1940) described the larva as having a blunt tooth on each antero-lateral angle of the clypeus, and abdominal segments 2 to 7 as having tergal (dorso-lateral) sutures. These larval features would place *Elsianus* close to *Stenelmis* from which it may be distinguished by having the propleuron divided into 2 parts (fig. 40).

Heterelmis Sharp

Genotype: *Heterelmis obscura* Sharp. Mexico. Monobasic.

Three of the 15 exclusively New World species of this genus have been recorded from the Southwest. Although in general appearance the adults are rather unlike *Microcylloepus*, with which they are frequently collected, the two genera are closely related. Each mandible of the adult (fig. 8) has a conspicuous narrow lateral lobe or tooth, the last abdominal sternite is prolonged on each side as a distinct process, somewhat as in fig. 9, which fits close to the adjacent margin of the elytron. Each anterior tibia has a patch of hairy tomentum. *Heterelmis* adults are generally broader than *Microcylloepus*, the body being more ovate, and the dorsal surface usually is not as roughly sculptured. In our species of *Heterelmis* there is a strong median transverse pronotal depression (fig. 13) which if present in *Microcylloepus* is in the anterior 1/3 or 2/5. The closely similar larva of *Heterelmis* is readily recognized by the 4 diagonal rows of strong tubercles on each side of the first 8 abdominal tergites (fig. 47). Diagonal rows are present on *Microcylloepus* but the tubercles are flat and more irregularly arranged as in fig. 50. The 8 pronotal rows of tubercles in *Heterelmis* (fig. 49) are distinct but irregular, the last row on each side branched at apex. *Microcylloepus* has the pronotal tubercles (fig. 51) irregularly arranged.

Microcylloepus Hinton

Genotype: *Stenelmis pusillus* LeConte. Subsequent designation.

Of some 25 species occurring in the New World, only about half a dozen have been found in the United States. Adults are somewhat like smaller versions of *Stenelmis* but are readily distinguished by having patches of hairy tomentum on the tibiae. They are more closely related to *Heterelmis* based on the presence of a narrow lateral marginal lobe or tooth on each mandible of the adult, (fig. 8) but they may be distinguished by having the transverse pronotal groove (fig. 11) located in anterior 1/3 or 2/5, and by the presence of a median longitudinal pronotal impression anterior to two diagonal swellings. Full grown larvae of *Microcylloepus* and *Heterelmis* have the mesopleuron and metapleuron each divided into 3 parts, (fig. 48); occasionally smaller *Microcylloepus* larvae have but 2 pleural parts. Mexican larvae were described by Hinton (1940) as having but 2 parts. The pronotum of the larva of *Microcylloepus* (fig. 51) has the tubercles more regularly disposed than those of *Heterelmis* (fig. 49).

Neoelmis Musgrave

Genotype: *Neoelmis gracilis* Musgrave. Puerto Rico. Original designation.

This genus of 23 species is confined to the New World and only one small species, *caesa* LeConte, is known to occur in Texas. The adult is readily distinguished from other genera by the combination of an entire lateral pronotal carina (fig. 14), transverse depression at about middle of pronotum, and the finely serrate carina which parallels the lateral pronotal margin (fig. 15). It is the only genus studied which has pronotal foveae near the carinae. No North American larvae have been examined but they were described by Hinton (1940). In his key to the larvae of the Mexican genera of Elmidae the anterior margin of the head of *Neoelmis* is described as without a tooth on each side, but his description states "anterior margin on each side between base of antenna and clypeus with a short, indistinct, blunt tooth." The propleuron is described as being divided into 2 parts, each mesopleuron and metapleuron also being divided into 2 parts. The first 7 abdominal segments have pleura. These larval features would appear to relate this genus to *Elsianus, Stenelmis* and *Ordobrevia.* From *Elsianus,* with which Hinton compared it, *Neoelmis* was distinguished by the absence of tergal (dorso-lateral) sutures. The prothoracic pleuron, if actually divided by a suture, is unlike that of *Stenelmis* and *Ordobrevia* which have no indication of a suture between the two parts.

(To be continued)

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